regions of clouds and rain. See the accompanying chart of May 22, 1913 (fig. 1, XLIV—22).

Studies of this kind render it evident that a condition to be considered in forecasting rainfall is that of converging winds.

In figure 1 the areas of converging winds exceeding 1 on the scale are inclosed with blue lines and the areas of rain are indicated by the symbol R. Since the convergence of the wind on which the rainfall depends is determined by the distribution of pressure, it is possible from a chart showing the anticipated distribution of pressure to forecast both wind and rain.

Plotting wind arrows along the lines of equal pressure according to the relation known to exist in the Northern Hemisphere (not considering speed), the region of converging winds can be easily selected and indicated by shaded areas. In this way the shaded area becomes the predicted area for rainfall.

The method used by me in the Argentine weather service is to predict the pressure distribution for the succeeding day and then draw in the winds and areas of rain. Experience teaches, however, that rain will not result from converging winds in areas where the [relative] humidity is low (60 per cent or less) and the rain area is omitted in such areas. Doubtless such forecasts will increase in accuracy with increasing knowledge and improvement in the method.

Plotting the divergence of the wind in red and the convergence in blue discloses the fact that diverging winds are the usual condition around centers of high pressure and converging winds around centers of low pressure. But this condition is frequently reversed. In the case of reversal there is rain within the area of high pressure where there exist converging winds, and fine weather in the low pressure where there exist diverging winds. Another example of the relation of rainfall to converging winds is shown in the accompanying figure 2 (XLIV—23) for May 3, 1913.

It is not meant to be understood that converging winds are the only factor in rain production. Temperature and humidity are also important factors. It will perhaps be possible to illustrate the effect of temperature distribution at some later date.

The effect of topography appears evident in figure 3 (XLIV—24). Here a broad stream of air is being drawn from the ocean up the gentle slopes of the Appalachian Mountains by a storm of unusual violence and extent, resulting in a long strip of rain along the eastern slope while on the western side of the mountain range where the air is descending the slopes, the sky remains clear notwithstanding the convergence of the wind. On the other hand with a well-defined low pressure over the ocean it frequently clears on the eastern slopes of the mountain while it is still raining or snowing on the western.

LONG-RANGE FORECAST OF THE WINTER MINIMUM TEMPERATURE FOR HAMADA, JAPAN.[1]

By M. ISIDA.

In western Japan there is a well-tried weather proverb current among laymen, to the effect that a severe winter is preceded by an abnormally hot summer.

The author of the paper here abstracted, has for his object the testing of this piece of weather lore by means of

the data from instrumental observations, and he has arrived at the striking result that the minimum temperature of the coming winter [at least for the locality studied] can be calculated with great accuracy from the mean temperature of the past summer.

TABLE 1.—*Observed and computed winter minimum temperatures at Hamada, Japan, 1893–1913.*

Year.	Mean summer temperature, T.	Winter minimum temperature.		$t_o - t_c$.
		Observed t_o.	Calculated t_c.	
	°C.	°C.	°C.	°C.
1893	21.8	−3.7	−3.2	−0.5
1894	23.5	−8.7	−7.7	−1.0
1895	22.1	−4.3	−4.0	−0.3
1896	22.5	−5.3	−5.1	−0.2
1897	21.3	−2.1	−1.8	−0.3
1898	21.9	−3.6	−3.5	−0.1
1899	22.2	−4.2	−4.2	0.0
1900	22.2	−3.2	−4.2	1.0
1901	21.5	−2.0	−2.3	0.3
1902	21.5	−3.2	−1.9	−1.3
1903	22.3	−3.6	−4.5	0.9
1904	21.6	−2.3	−2.6	0.3
1905	22.3	−4.6	−4.6	0.0
1906	21.6	−2.0	−2.6	0.6
1907	21.8	−3.7	−3.2	−0.7
1908	21.8	−2.1	−3.1	−1.0
1909	22.4	−4.6	[−4.8]	[−0.2]
1910	22.0	−3.8	−3.8	0.0
1911	21.3	−2.8	−1.9	−0.9
1912	22.0	−2.9	−3.6	0.7
1913	21.0	−0.9	−1.1	0.2
1914	22.9			

[1] Figures in brackets were recomputed.—C. A., jr.

Table 1 gives in its second column the mean air temperature (T) at Hamada, on the west coast of Japan [long. $132\frac{1}{4}°$ E.; lat. 35° N.], for its warm season or about May 11 to September 20. In the 3d, 4th, and 5th columns are given, respectively, the observed minimum temperature, t_o, of the following winter, the calculated minimum temperature, t_c, as obtained by means of the author's equation $t = 55.44 - 2.69\,T$, and the difference $t_o - t_c$.—T. O[kada].

CIRRUS DIRECTIONS AT MELBOURNE AND STORMS AFFECTING VICTORIA.[1]

By E. T. QUAYLE, B. A., Assistant.

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(Abstracted for the REVIEW, by A. J. Henry.)

Systematic observations of the direction of movement of cirrus clouds have been made in Melbourne for many years. The results of these observations for the period 1895 to 1912 have been correlated with the various cyclonic systems which affect the weather of extreme southeastern Australia.

Mr. Quayle groups the cyclones of Australia under eight types, of which by far the greater number belong to the type Antarctic V-depressions. These are first observed as they round Cape Leeuwin, distant from Melbourne about 1,800 miles. Cirrus observations at Melbourne are evidently made with considerable precision and probably by means of a nephoscope. The manner of grouping the data, as explained by the author, was about as follows:

For each cirrus direction observed at Melbourne there was noted the distance of the barometric trough of the depression or the cyclonic system from Melbourne, the departure from the mean cloud direction for that distance, the daily rate of motion of the trough, the time of its passage over Melbourne, and the intensity of the storm at that place, as indicated by the barometer level.

From the facts thus ascertained a table was prepared, showing the mean cirrus direction over Melbourne for the various distances of the storm trough. These, as the author remarks, varied from month to month in a most interesting fashion. The trough distances varied from 100 to 1,300 miles. The mean direction of cirrus in Australia, as in most other parts of the world where they have been systematically observed, is from west to east. The author found it convenient to call true west zero; that is, a movement from west to east was entered as zero when the direction was from true west. When the deviation from true west was to the north, it was recorded as plus (+) so many degrees, and when to the south it was recorded minus (−) so many degrees.

The most northerly average cirrus direction for any trough distance was in August, when for troughs distant from Melbourne 1,000 miles it was slightly north of west, +1°; at a trough distance of 500 miles for the same month the deviation was +23°, or west 23° north, and for trough distance of but 100 miles the deviation was west 41° north. The extreme southerly deviation for trough distance of 1,000 miles was −27° in December; for trough distance 500 miles west 3° south, in the same month, and for all trough distances less than 400 miles the deviation is always to the north, and generally from 25° to 30°. The seasonal shift of the upper currents thus brought out is a phenomenon of world-wide distribution but the apparent control of cirrus direction by cyclonic circulations has not been observed in the United States, so far as the writer is aware.

A casual inspection of the synoptic cloud charts of the United States Weather Bureau extending over a number of years leaves the impression that the direction of cirrus clouds in the United States is practically independent of either cyclonic or anticyclonic circulations. It is probable that the cloud directions as recorded in the daily observations of the Weather Bureau, viz, to the eight principal points of the compass only, are not sufficiently precise to show the deviations observed in Australia. Precise observations of cloud directions made at Blue Hill Observatory [2] show that the mean direction of the cirrus is different for cyclones which advance from different directions, and that in general the cirrus tends to move in the same direction as the accompanying cyclones and anticyclones move. The movement of the cirrus is, however, on the average, from a slightly more westerly direction than that of the accompanying cyclone or anticyclone.

The following are some instances of the significance of cloud movements in weather forecasting as given by Mr. Quayle:

(1) If the first cirrus observed when a storm is approaching is from the SSW or SW, little rain may be expected.

(2) If, however, it veers rapidly northward as the storm approaches, and, especially if in the case of an "Antarctic" low, for any given distance of the trough the direction of movement reaches a point more northerly than the average for that distance, good general rains may be expected.

(3) If, in addition to (2), the trough is moving slowly, the storm is likely to prove cyclonic round a center passing either over Tasmania, Bass Strait, or inland Victoria. The more northerly the track of the center the better the rainfall, as a rule.

(4) Cirrus movements beginning well, but failing to maintain their northward backing or tending to disappear, suggest either the destruction of the storm, or its deflection into the far interior of the continent, or possibly its slipping southward from the Bight. If passing northeastward from the Bight into New South Wales or Queensland, cirrostratus is usually visible low down in the northwestern horizon and lying parallel to it.

(5) Movement persisting from some northerly point in spite of locally fine weather is a very reliable sign of rain, especially over the interiors of New South Wales and Victoria.

(6) Cirrus tending easterly through north indicates the storm center to be passing eastward north of the observer, while directions between E and SSE generally go with an active storm center off the New South Wales south coast line, with much rain there and in East Gippsland, and high pressure over Tasmania or southwestern Victoria.

(7) Cirrus coming from the south (SSE–SSW) may have no apparent relation to storm systems, and is often seen in purely anticyclonic weather. It is also seen occasionally as the result of storm energy when the center of a vigorous cyclone is passing over or not far south of Melbourne, or has formed somewhere off Gabo Island. But, whatever its relationship, cirrus from this direction indicates conditions very unfavorable to the development or eastward progress of Antarctic disturbances approaching from the west.

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[2] *Clayton* in Annals of the Astronomical Observatory, Harvard College, vol. 30, Part IV.